

PMDX-170

Slotted Optical Sensor



User's Manual

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1.0 Overview

This document describes the configuration and operation of the PMDX-170 Slotted Optical Sensor. The PMDX-170 Slotted Optical Sensor is useful for mill or lathe spindle speed sensing and for lathe threading index position pickup, and for limit or home switches on machines where dust and debris are not a problem.

1.1 Important Safety Information

The PMDX-170 Slotted Optical Sensor is intended for integration by the purchaser into industrial control systems. It is solely the purchaser's responsibility to assure that the system is configured in a manner consistent with applicable safety requirements. Practical Micro Design, Inc. does not control how these parts are integrated into the purchaser's system and cannot be responsible for guaranteeing the safety of your system.

The PMDX-170 Slotted Optical Sensor may be used for limit or home switch applications only if dust, debris, coolants or cutting oils are not a problem.

The PMDX-170 Slotted Optical Sensor is not guaranteed to be fail-safe. The system into which the PMDX-170 Slotted Optical Sensor are installed should provide fail-safe protection and emergency stop capability.

Automated machine tools, into which the PMDX-170 Slotted Optical Sensor may be integrated, can cause injury. Precautions should be taken to assure that operators are trained in their proper operation and safety procedures, and that they are protected from moving parts that may be under remote control and may move unexpectedly.

This product may not be used in life support or other critical safety applications.

1.2 Warranty Summary

The PMDX-170 Slotted Optical Sensor are warranted against failure due to defective parts or workmanship for 90 days from the date of sale. Refer to Appendix A for complete warranty details.

NOTE: If you have an item requiring service, please see the support page on the PMDX web site (<http://www.pmdx.com>) for return instructions.

The purchaser must pay shipping to return the unit to PMDX. For repairs covered under warranty shipped to a USA address we will ship the repaired unit back to you via ground transportation at our expense. Repairs are normally completed within 10 business days. See Appendix A for our complete warranty details. **Please see the support page on our web site (<http://www.pmdx.com>) for full details of our repair and shipping policies.**

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1.3 Features

The PMDX-170 Slotted Optical Sensor has the following features:

- Optical interruption sensor for a disk with holes or for a moving flag
- Slot width of 3 mm with center of sensing zone 2.5 mm below top of sensor
- Small size 1.500" by 0.720" circuit board is easy to mount using two screws
- Two mounting orientations possible using holes in circuit board or in sensor body
- Easy to use clamp style screw terminal strips for connections
- LED indicator for sensor output status
- Signals are conditioned by a Schmidt trigger to avoid multiple false transitions
- Both a True and a False output are provided so user can select desired polarity
- Outputs are NPN "open collector" style and provide either an open circuit or a path to ground depending on state of sensor
- Outputs work directly with PMDX breakout board inputs and any other boards that provide a "pull-up"
- Sensor may be powered by any DC voltage from 5 volts to 25 volts
- Output voltage is independent of supply voltage
- Response time of less than 10 micro-seconds
- Mounting area of circuit board is free of electrically conducting PCB traces
- SMT component side is conformal coated to help resist harsh environments

1.4 Updates to this Manual

Check the PMDX web site for revisions or updates to this manual (<http://www.pmdx.com>). The latest revision of this manual is available on the PMDX-170 Slotted Optical Sensor page (follow the links from the main page).

2.0 Installation and Operation

These sensors are useful for mill or lathe spindle speed sensing and for lathe threading index position pickup. While you may be able to use these sensors for limit or home switches they are recommended for these applications only if dust, debris, coolants, or cutting oils are not a problem.

Note that all PMDX breakout boards have the necessary pull-up resistor on board and have power available to run the sensor so no external components are needed.

Pin Label	Description	Slot Open (LED on)	Slot Obstructed (LED off)
V+	+5V to +25V DC power supply	N/A	N/A
F	False (inverted) output (see section 2.3 for details)	pulled to GND (logic low)	floats (open-collector)
T	True (non-inverted) output (see section 2.3 for details)	floats (open-collector)	pulled to GND (logic low)
Gnd	Ground (power supply return)	N/A	N/A

Table 1 –Connector Pin-Out & Output Polarity

2.1 General Operating Constraints

The maximum pulse rate using the PMDX-170 can be as high as 25 KHz if the optical path meets the minimum on and off times. Your slot or hole should be sized according to the minimum on/off time and the speed that it is moving. In practice, a 6mm hole in a 4 inch disk spinning at 40,000 RPM would work.

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Larger holes or wider slots result in lower effective pulse rates. Under all circumstances, the slot must be fully blocked (or fully open) for a minimum of 20 μ s at maximum speed in order for the sensor to output a pulse. The exact width required for the interrupter depends on many factors, including the interface electronics and control software. For example, a large-value pull-up resistor will slow the response time of the sensor. All PMDX breakout boards have pull-up resistors that are compatible with this sensor. For other applications or other breakout boards we recommend a 1.0K ohm pull-up when using a +5V supply, or a 4.7K ohm pull-up when using a +24V supply. Finally, the time it takes the control software to read the output of the sensor will limit the maximum pulse rate and minimum interrupter width. The PMDX-170 is faster than most software sampling methods, so software performance will likely be the limiting factor. The bottom line is that, in general, you should experiment with your setup to determine the maximum operational limits.

2.2 Interruptor Design

Two types of interrupters can be used with the slotted optical sensor: a "flag" style, or a "solid with an opening" style. The "flag" style uses a small flag or tooth-shape protrusion to interrupt the LED/Sensor path at the reference position. The "solid" style uses a solid interrupter that has an opening of some kind at the reference position. When using a solid interrupter with an opening at the reference point, the opening must extend a minimum of 2.5mm above and 2.5mm below the center line of the LED/Sensor path (see Figure 1 on page 6). Therefore, if you are using a round hole, the hole must be 5mm diameter or greater.

<p>Warning: The actual size of the interrupter opening depends on the speed of the interrupter material and how short a pulse the PC can detect. The faster the device is moving (and/or the slower the PC), the larger the hole needs to be in order for the PC (or other hardware) to recognize the output pulse from the sensor. You may have to experiment to determine the exact size opening that your application requires.</p>

2.3 Output Signals

The slotted sensor has two open-collector outputs labeled "T" and "F", as shown in table 1 on page 4.

To obtain a valid logic level from a "floating" output, the output must have a resistor installed between the output signal and a power supply voltage. Usually this is a resistor whose value is between 1.0K ohms and 10K ohms, connected to a power supply between +5V to +25V VDC. See section 4.0 for information on the maximum voltage that may be attached to the output signal.

Note that all PMDX breakout boards have the necessary pull-up resistor on board and have power available to run the sensor so no external components are needed.

2.4 Mounting Options

The PMDX-170 can be mounted by two different methods. A mounting bracket can be attached to the side of the sensor (see the "End View" in the mechanical drawing), or to the top side of the board (see the "Top View" in the mechanical drawing). **Do not** put a mounting bracket on the bottom side of the circuit board. If your machine requires that you mount the board from the bottom side you must use 1/4" (or taller) #4 (or 1/4" outer diameter) **non-conductive** spacers between the circuit board and the bracket or panel.

The mounting holes in the sensor and the circuit board are sized for #4 hardware.

3.0 Mechanical Specifications

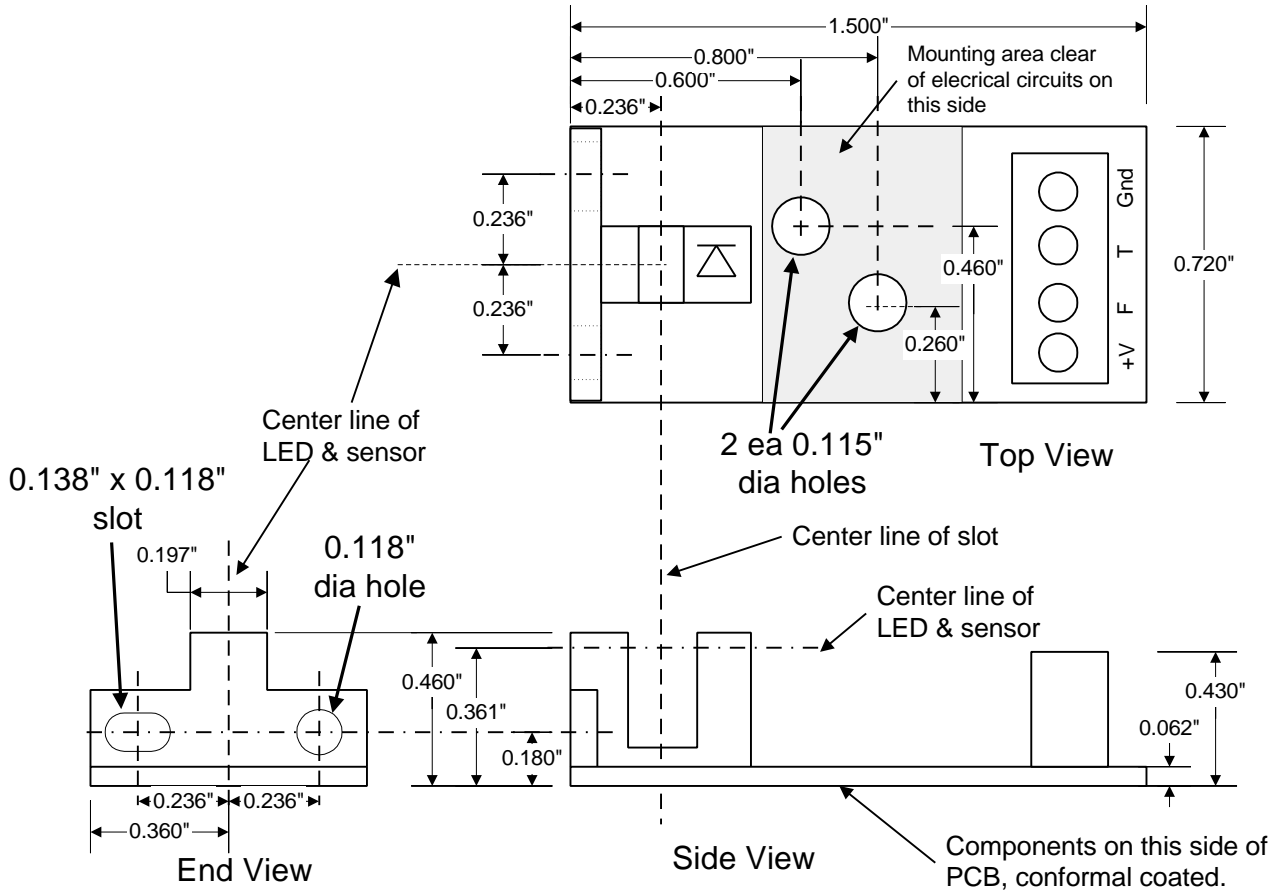


Figure 1 - PMDX-170 Slotted Optical Sensor Dimensions

WARNING: *The PMDX-170 Slotted Optical Sensor should be protected from liquids, dirt, or chips (especially metal chips which can cause shorts) coming in contact with the board.*

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4.0 Electrical and Environmental Specifications

Power Supply: +5V to +25V VDC input, 25 mA maximum

Output: Open-collector output
Max. output "low": 0.4V sinking up to 6 mA
Max. output "high": pull-up resistor to 25V maximum

Pulse Rate: in excess 25 KHz
10 μ s response time turning "on" or "off"
NOTE: See also section 2.1 for more information.

Environmental: Temperature: 0° to +55° C
Relative Humidity: 20% to 80% relative humidity, non-condensing

Appendix A – Warranty

Statement

Practical Micro Design, Inc. (PMD) warrants that this hardware product is in good working condition, according to its specifications at the time of shipment, for a period of 90 days from the date it was shipped from PMD. Should the product, in PMD's opinion, malfunction within the warranty period, PMD will repair or replace the product without charge. Any replaced parts become the property of PMD. This warranty does not apply to the software component of a product or to a product which has been damaged due to accident, misuse, abuse, improper installation, usage not in accordance with product specifications and instructions, natural or personal disaster or unauthorized alterations, repairs or modifications.

Limitations

All warranties for this product, expressed or implied, are limited to 90 days from the date of purchase and no warranties, expressed or implied, will apply after that period.

All warranties for this product, expressed or implied, shall extend only to the original purchaser.

The liability of Practical Micro Design, Inc. in respect of any defective product will be limited to the repair or replacement of such product. Practical Micro Design, Inc. may use new or equivalent to new replacement parts.

Practical Micro Design, Inc. makes no other representations or warranties as to fitness for purpose, merchantability or otherwise in respect of the product. No other representations, warranties or conditions, shall be implied by statute or otherwise.

In no event shall Practical Micro Design, Inc. be responsible or liable for any damages arising

- (a) from the use of the product;
- (b) from the loss of use of the product;
- (c) from the loss of revenue or profit resulting from the use of the product; or
- (d) as a result of any event, circumstance, action or abuse beyond the control of Practical Micro Design, Inc.

whether such damages be direct, indirect, consequential, special or otherwise and whether such damages are incurred by the person to whom this warranty extends or a third party.